



Reducing the disruptiveness of interruptions

Greg Trafton
trafton@itd.nrl.navy.mil
(Naval Research Laboratory)
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Collaborators (reverse alphabetical)

- Sarah Webster (GMU)
- Susan Trickett (GMU)
- Chris Monk (GMU)
- Farilee Mintz (ITT at NRL)
- Sheryl Miller (GMU)
- Miguel Carpio (GMU)
- Derek Brock (NRL)
- Tim Bowers (ITT at NRL)
- Debbie Boehm-Davis (GMU)

- Erik Altmann

Interruptions are frequent



- Everyone gets interrupted all the time (phone calls, knocks on your door, etc.)
- We observed Navy Meteorologists as they were making a forecast. The head forecasters got interrupted every 80 seconds on average over 2 hours (!)



Interruptions are irritating

- Most interruptions are not “on task”
- Where do interruptions come from?
 - Other people (friend coming in to ask about lunch)
 - Yourself (You just come up with a great idea to make your job easier)
 - Environment (phone ringing, fire alarm, etc.)
 - Software (“Assistants”, email alerts, etc.)
 - (Sometimes they are relevant to what you’re working on)
- It is not clear what to do about interruptions at all:
 - Minimize or remove them? (sometimes not possible)
 - **Figure out ways of helping you resume after an interruption? How?**

Theory: Memory for Goals



- Look to theory for answers to these questions
- The interruption process is all about interrupted and resumed goals
 - Go downstairs → find elevator → push down button
 - Write letter → open MS Word → File:New Presentation
- We have a theory called Memory for Goals (Altmann & Trafton, 2002; Trafton et al., 2003)
- Theory is a formal (mathematical), computational theory of how people think about goals and subgoals



Theory: Memory for Goals

What practical things does it say?

- The memory for goals theory is described at multiple levels: mathematical, computational, and qualitative
 - If you're interested in the mathematical or computational level, let me know
- Outline of this talk
 - Demo of an interruption
 - Timeline for an interruption
 - Qualitative description of the theory
 - Demo of helper-application that could facilitate people's resumption process
 - Evidence that helper-application really works
 - Diversion: How long are interruptions disruptive?
 - A few suggestions of what you can do to help yourself

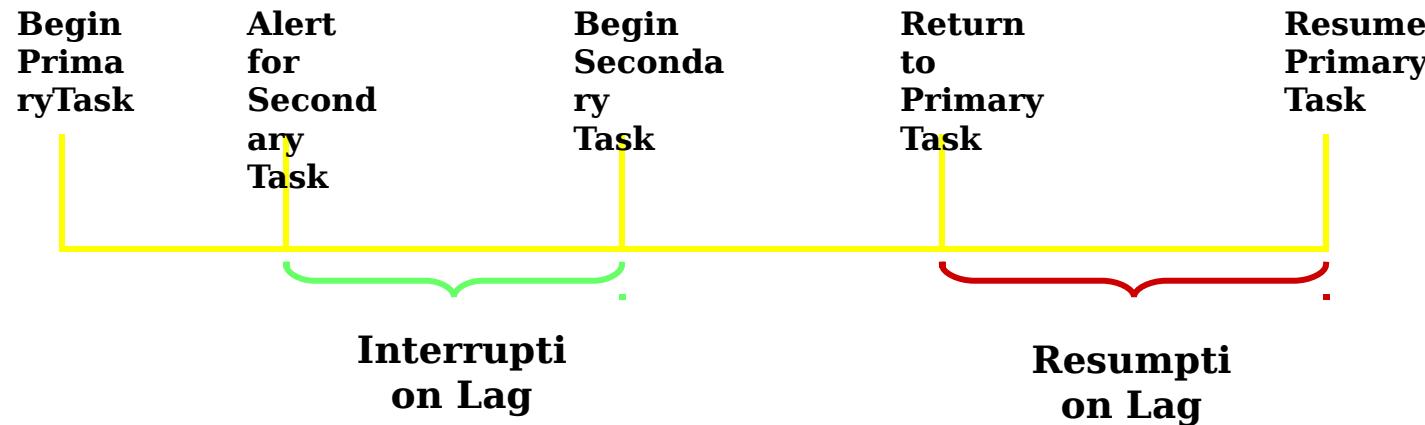
Interruptions in action (from the public domain)



QuickTime™ and a
YUV420 codec decompressor
are needed to see this picture.



Timeline of an Interruption



What affects the resumption lag? How do we help people get back on task as quickly as possible?

How do we make sure people resume where they left off
(or at least have the opportunity to?)

Theory of Interruptions

Qualitative Description



- Our theory makes 3 key predictions about interruptions:
 - After being interrupted, the goal(s) of the primary task will decay (e.g., you forget things when you're away from it)
 - Preparing to resume a task can slow down decay
 - Prospective encoding of goals (forward-looking)
 - Retrospective rehearsal of current state info
 - Things in the environment can facilitate resumption
- (Decay depends on lots of things: how well you know the goal, how many times you've done that goal before, how awake you are, etc.)



Goals decay over time

- The longer the interruption is, the harder time you're going to have remembering what you were working on
- The bad news: Most of the time, you forget what you were doing within 15 seconds -- only very short interruptions have little disruption
- The good news: There are things you can do to slow down decay or give you some help...

Preparing to resume a task can facilitate resumption



- Different kinds of preparation:
 - Prospective goal encoding (when I come back from this interruption I want to change the slide's background color)
 - Retrospective state rehearsal (I just finished changing the font)
- Prospective thinking (forward-looking) is better: take 2 seconds during the interruption lag to figure out what you're going to do next
- Tie your next step to an object in the environment (objects, not actions)

Things in the environment can facilitate resumption



- Looking at the environment (current state) can help you remember what you were working on after resuming an interruption and what you were going to do next
- Subtle cues (like a cursor) may not be enough (probably better than nothing)
- If this is all true, we should be able to build a helper-application to make extremely obvious resumption helpers that will help people get back on task quickly and efficiently



Supply Pool

| | |
|-----------------------|-------------|
| Munitions: | (qty avail) |
| Heavy-tank munitions: | 309 |
| Light-tank munitions: | 960 |
| Fuel Depot: | |
| Fuel tanks: | 65 |
| Fuel (gallons): | 2925 |
| Vehicles: | |
| Heavy tanks: | 6 |
| Light tanks: | 8 |

Heavy Tank Outfitter

| | |
|--------------------------------------|---|
| Munitions: | Fuel (gallons): |
| 49 | 135 |
| 48 | 134 |
| 47 | 133 |
| Maximum payload (lbs): 5500 | |
| Current payload (lbs): 5255 | |
| <input type="button" value="Reset"/> | <input style="background-color: red; color: white; border: 1px solid black; padding: 2px 10px; font-weight: bold; border-radius: 5px;" type="button" value="Issue Tank"/> |

Light Tank Outfitter

| | |
|--------------------------------------|---|
| Munitions: | Fuel (gallons): |
| 128 | 98 |
| 119 | 89 |
| 118 | 88 |
| Maximum payload (lbs): 3500 | |
| Current payload (lbs): 3370 | |
| <input type="button" value="Reset"/> | <input type="button" value="Issue Tank"/> |

Mission Composer

[Open Supply Pool and Tank Outfitter Dialogs](#)

Use tank outfitter dialogs to issue tanks:

| | |
|------------------------|----------------------|
| Available Tanks | Mission Tanks |
| H1 H2 H3 H4 | L2 |

>> Allocate to Mission >> **<< Retract <<**

Select one or more destinations for mission:

| | |
|---------------------------|--|
| Choices | Sequence |
| Desert Camp River Town | >> Add >> << Remove << |

Map Window **Go on Mission**

Mission Report:

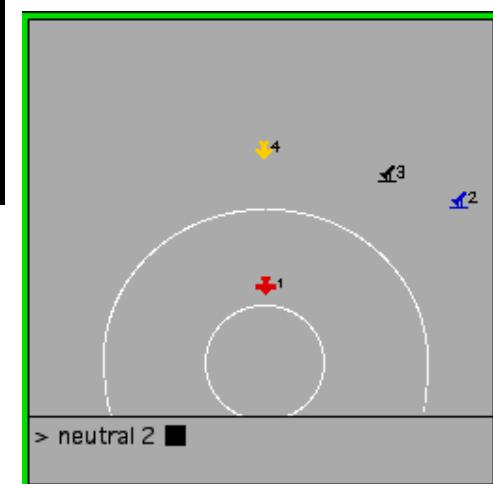
```

Report of Mission-1:
LIGHT-TANK L1 heading toward Mountain Village
from Base (at mile 0)
There are obstacles ahead
LIGHT-TANK L1 encountering 'ROCKS' at mile 139
LIGHT-TANK L1 encountering 'RIVER' at mile 141
LIGHT-TANK L1 engaging DESTINATION Mountain Village at mile 143
LIGHT-TANK L1 is out of munitions at mile 143
LIGHT-TANK L2 heading toward Mountain Village
from Base (at mile 0)
There are obstacles ahead
LIGHT-TANK L2 encountering 'ROCKS' at mile 139
LIGHT-TANK L2 encountering 'RIVER' at mile 141
LIGHT-TANK L2 engaging DESTINATION Mountain Village at mile 143
DESTINATION Mountain Village defeated
(<--end--> Mission-1)
  
```

Defeated Destinations **Spent Tanks**

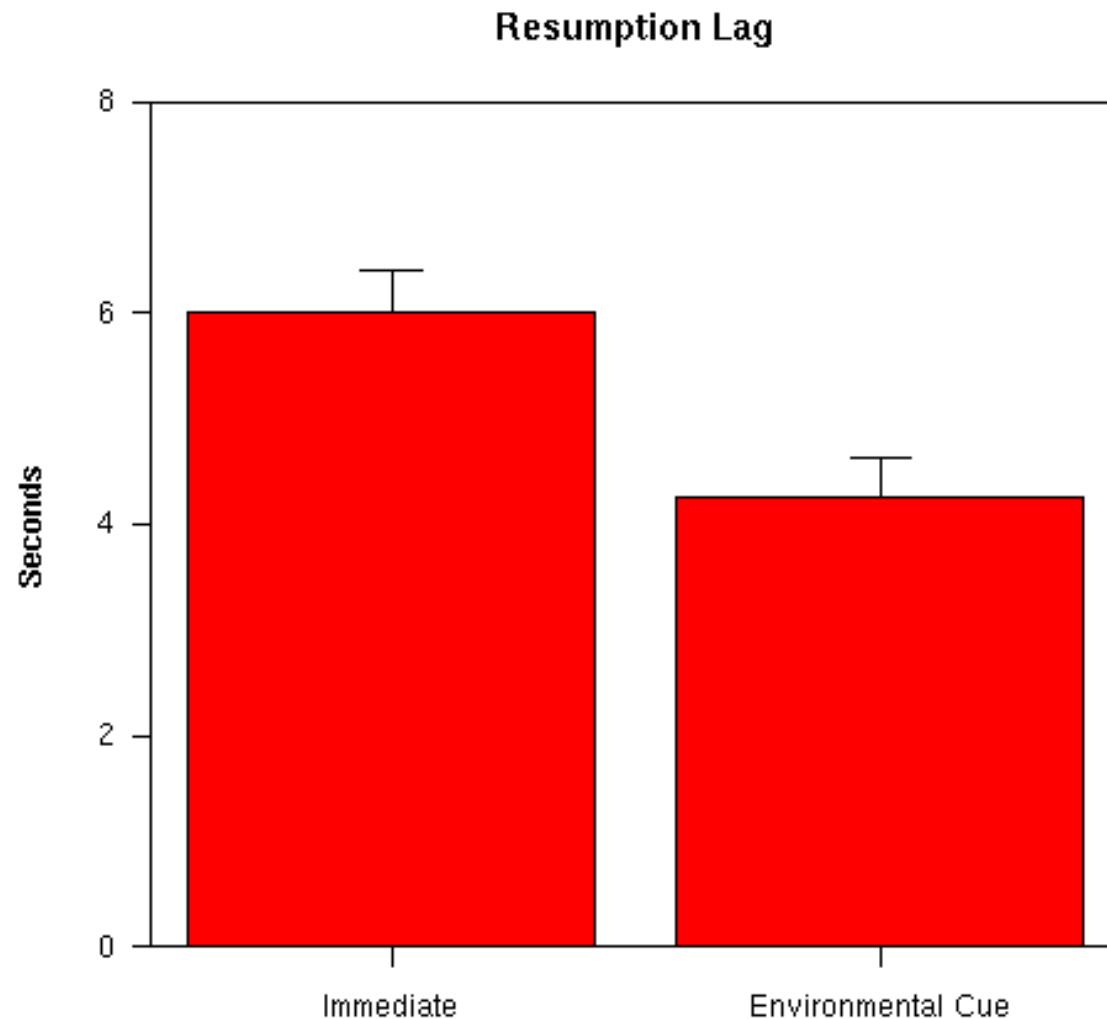
| | |
|------------------|----|
| Mountain Village | L1 |
|------------------|----|

RESET





Experiment: Environmental Cues



Diversion: How disruptive are interruptions really?

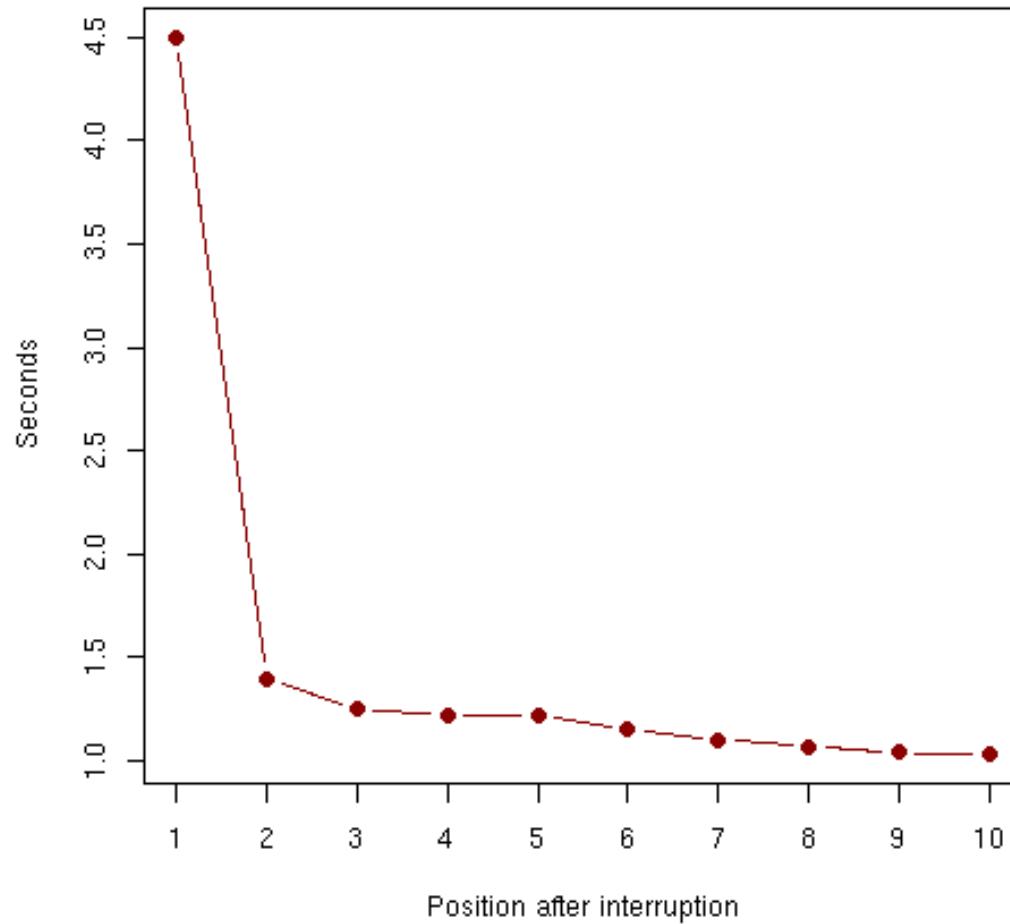


- Previous experiments have shown that getting back into a task with a 45 second interruption takes about 4-6 seconds
- Is that it? Is that the only part that is disruptive?
- Short Answer: No, the effects of an interruption last for quite a long time (small but reliable)

Long Answer: Interruptions are disruptive even after your head is back in it



Speedup after an interruption (Interclick)



Avoid interruptions like the plague (if you want to get stuff done)



- Don't set your email to automatically alert you when you get email (self-interruptions can be prepared for better)
- Don't use Chat
- Turn off all “intelligent” agents that interrupt you (e.g., clippy)



Things you can do to minimize the disruptiveness of interruptions

- When you get interrupted, take 2 seconds to figure out what you're going to do next (e.g., let the phone ring twice) **(rehearsal)**
 - (Similar to saying the person's name when you are introduced to someone so you won't forget their name)
- Make that next thing you're going to do an object you can see **(environmental cue)**
- Leave your cursor next to what you're going to do **(marker for environmental cue)**
- One day we may have general software that shows you what you had just done or what you will probably do next... (what we can do)